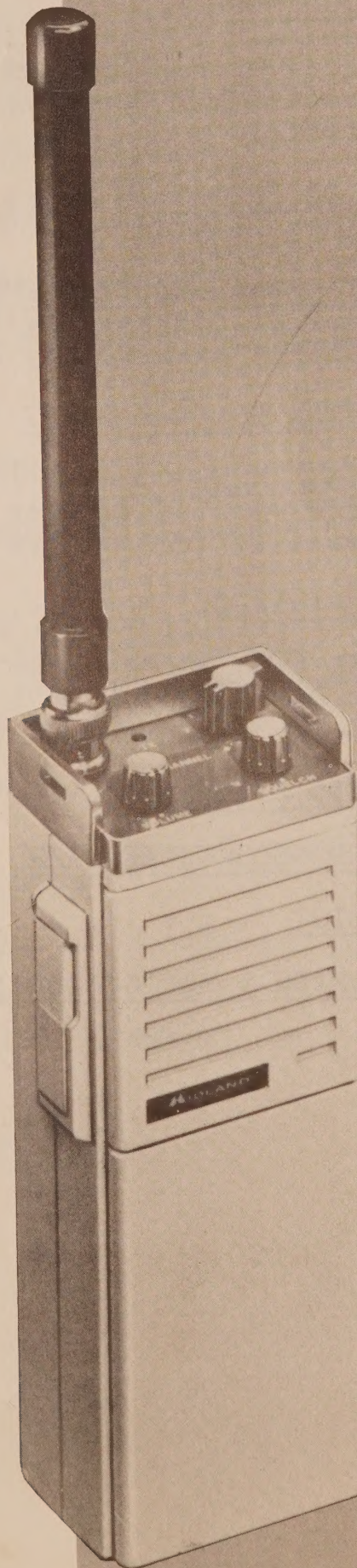


**MIDLAND**  
VHF MARINE RADIO



# SERVICE MANUAL 50-050

Hand Held, 4 Channel  
VHF/FM Marine  
Transceiver



**MIDLAND**  
OVERSEAS LTD.

1690 North Topping Avenue  
Kansas City, Missouri 64120

MANUAL NO. 50-05000

09-050-SM-2/82-1M



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Power source . . . . .	Self-contained nickel-cadmium battery, 12V DC
Temperature range. . . . .	-30°C to +60°C
Antenna impedance (external) . . . . .	50 ohms, unbalanced
Microphone . . . . .	Self-contained
Speaker . . . . .	8 ohm
Frequency control. . . . .	Quartz crystal
Frequencies of operation . . . . .	156.00 MHz - 162.55 MHz
Receiver and transmitter performance bandwidth without adjustment . . . . .	2.0MHz
Frequency tolerance and stability . . . . .	<u>±</u> .002% Tx and Rx
High humidity . . . . .	90% @ 40°C per EIA RS-388, Sec. 3.2.2
Vibration stability . . . . .	EIA RS-388, Sec. 3.2.4
Shock stability . . . . .	EIA RS-388, Sec. 3.2.5
Channel capability . . . . .	Up to 4 channel transmit/ receive
Nominal dimensions . . . . . (not including controls, antenna)	62mm (W) X 42MM (D) X 188mm (H)
Duty cycle . . . . .	500SC Battery
10 - 10 - 80	7 hrs.
5 - 5 - 90	10 hrs.
5 - 0 - 95	10 hrs.



# RECEIVER PERFORMANCE SPECIFICATION

50-050

Refer to EIA RS-388, EIA RS-204-B, EIA RS-316-B and DOC RSS-182, for Method of Measurement and Standard of Performance.

Sensitivity:	20dB NQ	0.50uV @ 50 ohm
	12dB SINAD	0.35uV @ 50 ohm
Squelch Sensitivity:	Threshold	0.25uV max or 6dB SINAD
	Tight	.9uV min, 1.1uV max
Squelch Blocking:	12dB	
Receiver Attack (Squelch Release) Time:	100ms max	
Receiver Squelch Closing Time:	200ms max	
Modulation Acceptance Bandwidth:	7.5KHz min	
Adjacent Channel Two Signal Selec- tivity and Desensitization:	80dB @ <u>+</u> 30KHz, 30dB @ <u>+</u> 15KHz	
Spurious Response Attenuation:	70dB	
Intermodulation Spurious Response Attenuation: (measured at usable sensitivity)	60dB	
Audio Power Output:	500mw @ 8%THD @ 8 ohm	
Audio Frequency Response:	Per EIA and DOC Specifications	
Hum and Noise:	Unsquelched	40dB
	Squelched	50dB
Conducted Spurious RF Power:	200uV across 50 ohms (800pW) from DC to 1000MHz	

Refer to EIA RS-152-B, EIA RS-388, EIA RS-316-B, and DOC RSS-182 for Method of Measurement and Standard of Performance.

Carrier Power Output:	1 and 2 watts (switchable)
Modulation System:	PM
Audio Frequency Response:	Per EIA and DOC Specifications
Audio Frequency Harmonic Distortion:	6% @ 1000Hz for <u>+3.0</u> KHz deviation
System Deviation:	5KHz, maximum
Modulation Limiting:	Instantaneous peak clipping with low pass audio filter
Hum and Noise:	50dB
Occupied Bandwidth:	Less than -60dB from carrier power <u>+25</u> KHz
Transmitter Carrier Attack Time:	100ms max for 50% rated power
Conducted Spurious Emissions:	Less than 25uW, 1MHz to 1000MHz



RECEIVER CRYSTAL

Holder Style	HC - 25/U
Application	RX
Oscillation Mode	Fundamental
Nominal Frequency	16.14 to 16.87 MHz
Tolerance of Center Frequency	$+20 \times 10^{-6}$ at 25°C
Center Frequency Drift	(-30°C to +60°C): $\pm 20 \times 10^{-6}$
Aging	$+5 \times 10^{-6}$ /year
Usable temperature range	-30°C to +80°C
Load Capacitance	23 + 0.3 pF
Drive Level	1 mW
Equivalent Resistance	Less than 20 ohms
Electrostatic Capacitance	7 pF max
Insulation Resistance	500 Meg ohms at 100 VDC

$$F_x = \frac{F_{ch} - 10.7}{9}$$

TRANSMITTER CRYSTAL

Holder Style	HC - 25/U
Application	TX
Oscillation Mode	Fundamental
Nominal Frequency	13.00 to 13.55 MHz
Tolerance of Center Frequency	$+ 20 \times 10^{-6}$ at 25°C
Center Frequency Drift	(-30°C to +60°C): $\pm 20 \times 10^{-6}$
Aging	$+ 5 \times 10^{-6}$ /year
Usable temperature range	-30°C to +80°C
Load Capacitance	34 + 0.3 pF
Drive Level	1 mW
Equivalent Resistance	Less than 20 ohms
Electrostatic Capacitance	7pF max
Insulation Resistance	500 Megohms at 100 VDC

$$F_x = \frac{F_{ch}}{12}$$



## 1. Receiver RF Amplifier and 1st mixer

The incoming signal passes through the pre-selector circuitry (T1, C5 and T2) to the Dual Gate MOSFET RF Amplifier (Q1). The amplified RF signal is coupled through a filter (T3, C11 and T4) to the JFET First Mixer (Q2).

## 2. Receiver 1st Local Oscillator

The First Local Oscillator (Q10) employs a fundamental crystal, adjustable in frequency by trimmer capacitors in each of the four channels. The oscillator output is coupled through capacitor C13 to the source of the 1st Mixer Q2, producing the 1st I.F. of 10.7 MHz.

## 3. Receiver 1st I.F. Filter and Amplifier, and 2nd Mixer

The 1st Mixer output is filtered by crystal filter FL1, amplified by 1st I.F. amplifier Q3 and coupled through T7 to the JFET 2nd Mixer Q4.

## 4. 2nd Local Oscillator, Filter, I.F. Amplifiers and Limiter

The 2nd Local Oscillator (Q11) operates at 10.245 MHz. The oscillator output is coupled through capacitor C18 to the 2nd mixer, producing the 2nd I.F. of 455 KHz. Selectivity is added by the 2nd I.F. ceramic filter FL2. The 2nd I.F. signal is amplified by Q5-Q8, limited by Q9 and fed to the discriminator filter FL3.

## 5. Discriminator and Audio Circuitry

The Discriminator is composed of the discriminator filter FL3 and diodes D2 and D3. Phase shift variations are detected, causing D2 or D3 to conduct, developing an audio signal across the Volume Control VR2. Audio de-emphasis is accomplished by the network of R30 and C31. The audio signal from the volume control is fed to the audio preamplifier Q15, audio driver Q16, then amplified to  $\frac{1}{2}$  watt by the audio output stage Q17-Q18 and fed to the speaker.

## 6. Squelch

A portion of the audio signal is fed to the squelch control VR1. If no carrier is present, this audio signal will have a large component of high frequency noise. This noise component is amplified and filtered by Q12, detected by Q13 and applied to Q14. Q14 is turned on, removing the bias from Q15 and thus disabling the audio.

If an on-frequency carrier is present, the signal coupled to the squelch circuit will contain only a small high-frequency noise component. The output of Q13 will be reduced to a low level, turning off Q14 and allowing received audio to pass to the speaker.



## 7. Transmit - Receive Switching

During receive, Q29 is biased on by R97, furnishing a B+ voltage to the receiver. When the PTT switch is depressed, the bias to Q29 is shunted to ground through D9, turning off Q29. At the same time Q30 is biased on providing B+ voltage for the transmitter. The transmitter B+ voltage also biases D1, through R2, to a low impedance state, preventing transmitter RF from entering the receiver.

Zener diode D6 provides a regulated voltage for the transmit oscillator, modulator, and doubler stages.

## 8. Transmitter Crystal Oscillator and Modulator

The transmit oscillator operates as a 13.00-13.55 MHz fundamental oscillator with trimmer capacitors providing frequency adjustment for each channel. The oscillator output is coupled to the modulator Q20.

## 9. Transmitter Audio

Audio from the internal electret microphone is amplified by Q26 and Q27, limited by diodes D4 and D5 and fed to the deviation control VR3. Q28 functions as an integrator, processing the audio before it is fed to the modulator Q20.

## 10. Transmitter Multipliers

The modulator output is multiplied 12 times to the final transmit frequency through Q21, Q22 and Q23. These stages act, in order as doubler, tripler, and doubler.

## 11. Transmitter Driver and Final

The transmitter driver Q24 amplifies the RF signal to a level suitable to drive the final transistor Q25. RF output power of two watts is coupled through the low pass filter and matching network to the 50 ohm antenna.



The Midland 50-050 consists of three major assemblies as shown in the accompanying diagram: (A)—the battery assembly which is the rear case half, (B)—the circuit board/control plate assembly, and (C)—the front case half.

## Battery Replacement

For battery installation or replacement it is only necessary to remove the battery case cover by rotating the lock (1) counter-clockwise and lifting the cover up, starting at the top.

## Unit Disassembly

For crystal installation, alignment or service, the circuit board must be separated from the front and rear case halves. Remove the three battery case screws (2) and separate the battery case assembly, starting at the bottom end.

Remove the screw (3) and lift up on the bottom end of the circuit board. Slide the charge jack up and out of the retaining slot, then continue to lift the circuit board till the front case half can be separated.

## Unit Assembly

Reassembly of the 50-050 is generally the reverse of disassembly, but additional care should be taken. When mating the main circuit board and the case front, make sure the speaker and microphone wires are under the circuit board but not positioned so as to interfere with fit of the circuit board to the mounting post (4).

With the case front and circuit board at an angle, mate the two assemblies at the top, slip the charge jack in the retaining slot and press the bottom of the circuit board into the case front. Install and tighten the circuit board mounting screw (3).

Making sure no interconnect wires are extending past the circuit board edges, slip the top of the battery case under the control plate lip. Guiding the battery case interconnect wiring into the space between the charge jack and case bottom, press the battery case into position and insert the 3 retaining screws.

Install batteries and lock the battery cover in place.



## 7. Transmit - Receive Switching

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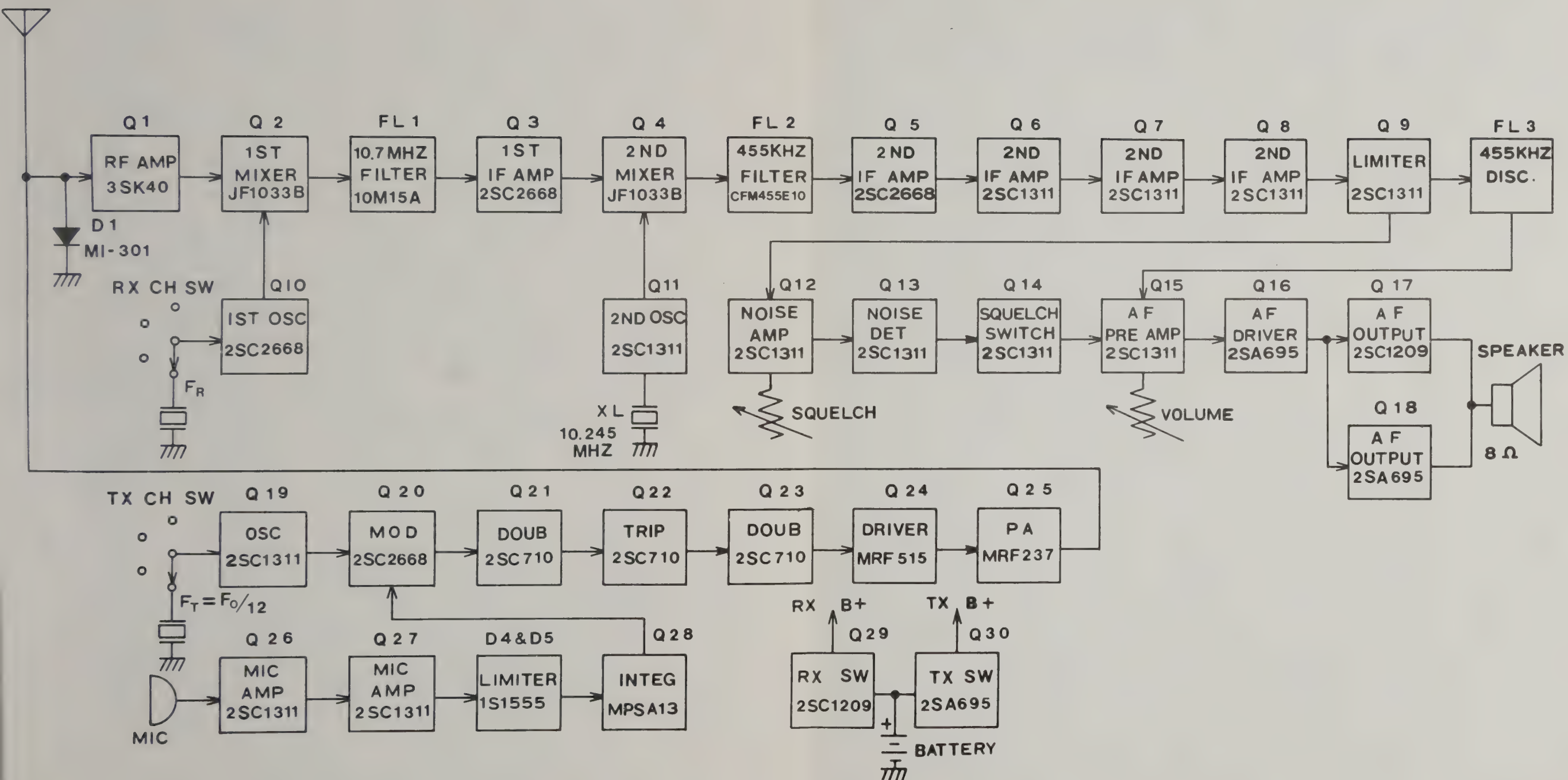
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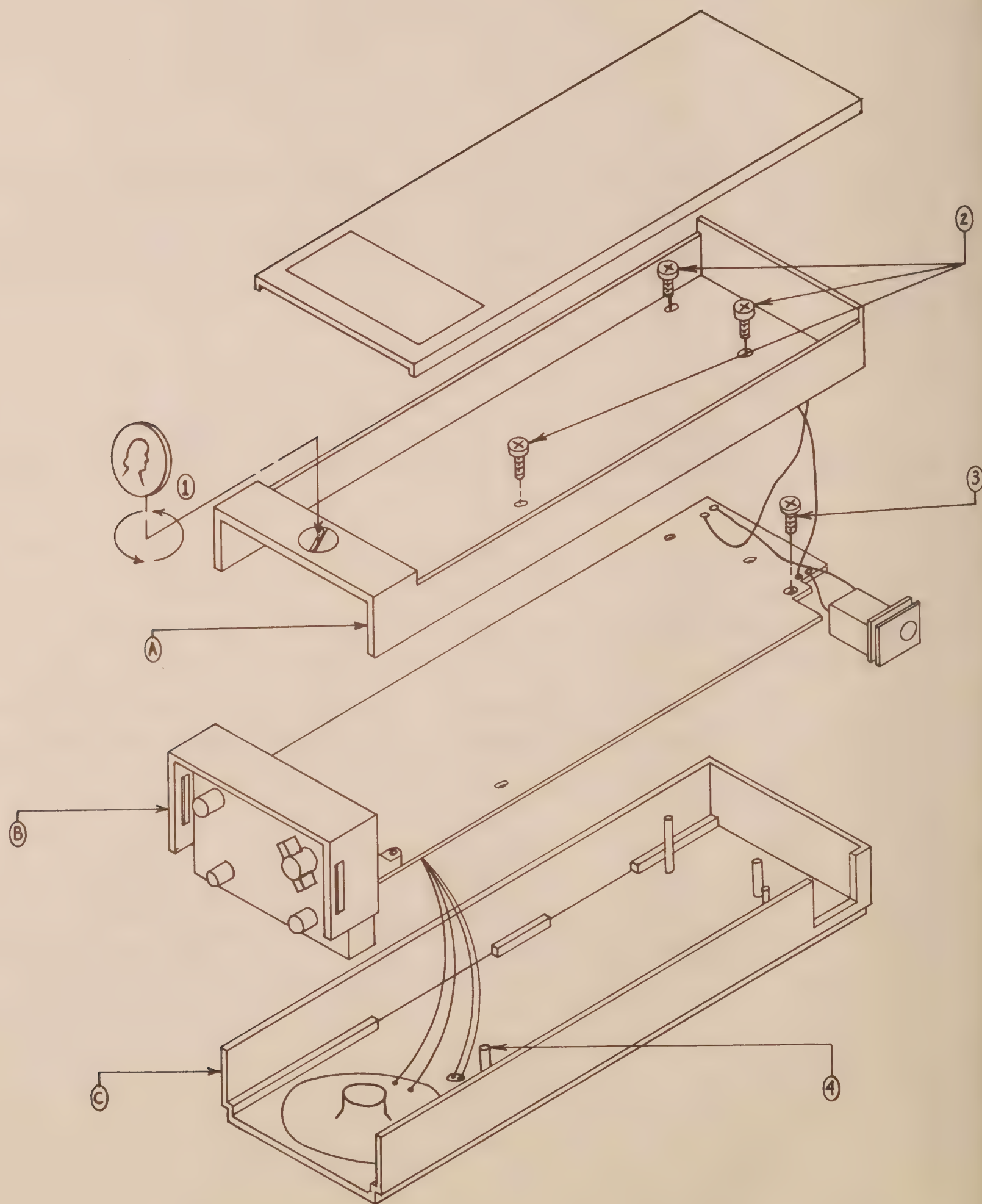


## BLOCK DIAGRAM

50-050









<u>F.E.T.</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>GATE1,GATE2</u>	<u>DRAIN</u>	<u>SOURCE</u>
Q1	3SK40/3SK45	0 5.65	10.96	0.57
Q2	JF1033B	0	10.59	1.93
Q4	JF1033B	0	9.97	1.9
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q3	2SC2668	2.67	11.1	1.95
Q5	2SC2688	0.72	1.2	0
Q6	2SC1311	4.75	4.97	4.15
Q7	2SC1311	0.63	0.79	0
Q8	2SC1311	4.25	4.95	3.74
Q9	2SC1311	0	2.03	0
Q10	2SC2688	2.35	10.14	1.68
Q11	2SC1311	2.1	2.88	1.71
Q12 SQ(UNSQ)	2SC1311	0.65(0.66)	1.08(0.95)	0
Q13 SQ(UNSQ)	2SC1311	5.4 (5.78)	6.5 (6.17)	5.0 (5.23)
Q14 SQ(UNSQ)	2SC1311	0.67(0.13)	0.02(9.85)	0
Q15 SQ(UNSQ)	2SC1311	0.02(7.88)	11.9(9.93)	0.36(7.42)
Q16 SQ(UNSQ)	2SA695	11.9(9.92)	0 (5.2)	11.9(10.58)
Q17 SQ(UNSQ)	2SC1209	0 (5.2)	12.0(12.0)	0.37(4.98)
Q18 SQ(UNSQ)	2SA695	0 (4.2)	0 ( 0 )	0.36(4.6 )
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q19	2SC1311	2.55(TX)	4.15(TX)	2.0(TX)
Q20	2SC2668	1.58(TX)	4.3 (TX)	0.9(TX)
Q21	2SC710	0.99(TX)	5.15(TX)	0.3(TX)
Q22	2SC710	0 (TX)	10.42(TX)	1.53(TX)
Q23	2SC710	0 (TX)	11.9(TX)	1.88(TX)
Q24	MRF515	0 (TX)	8.78(TX)	0 (TX)
Q25	MRF237	0 (TX)	11.9(TX)	0 (TX)
Q26	2SC1311	0.66(TX)	0.96(TX)	0 (TX)
Q27	2SC1311	4.9 (TX)	7.5 (TX)	4.46(TX)
Q28	MPSA13	1.66(TX)	2.6 (TX)	0.52(TX)
Q29	2SC1209	11.9(RX)	12.0(RX)	11.3(RX)
		0.97(TX)	12.0(TX)	0.21(TX)
Q30	2SA695	12.0(RX)	0.2 (RX)	12.0(RX)
		11.2(TX)	11.9(TX)	12.0(TX)
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q31	2SA733	10.6 (RX)	11.3(RX)	12.0(RX)
		11.1 (TX)	8.45(TX)	12.0(TX)



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#### Battery Replacement

For battery installation or replacement it is only necessary to remove the battery case cover by rotating the lock (1) counter-clockwise and lifting the cover up, starting at the top.

#### Unit Disassembly

For crystal installation, alignment or service, the circuit board must be separated from the front and rear case halves. Remove the three battery case screws (2) and separate the battery case assembly, starting at the bottom end.

Remove the screw (3) and lift up on the bottom end of the circuit board. Slide the charge jack up and out of the retaining slot, then continue to lift the circuit board till the front case half can be separated.

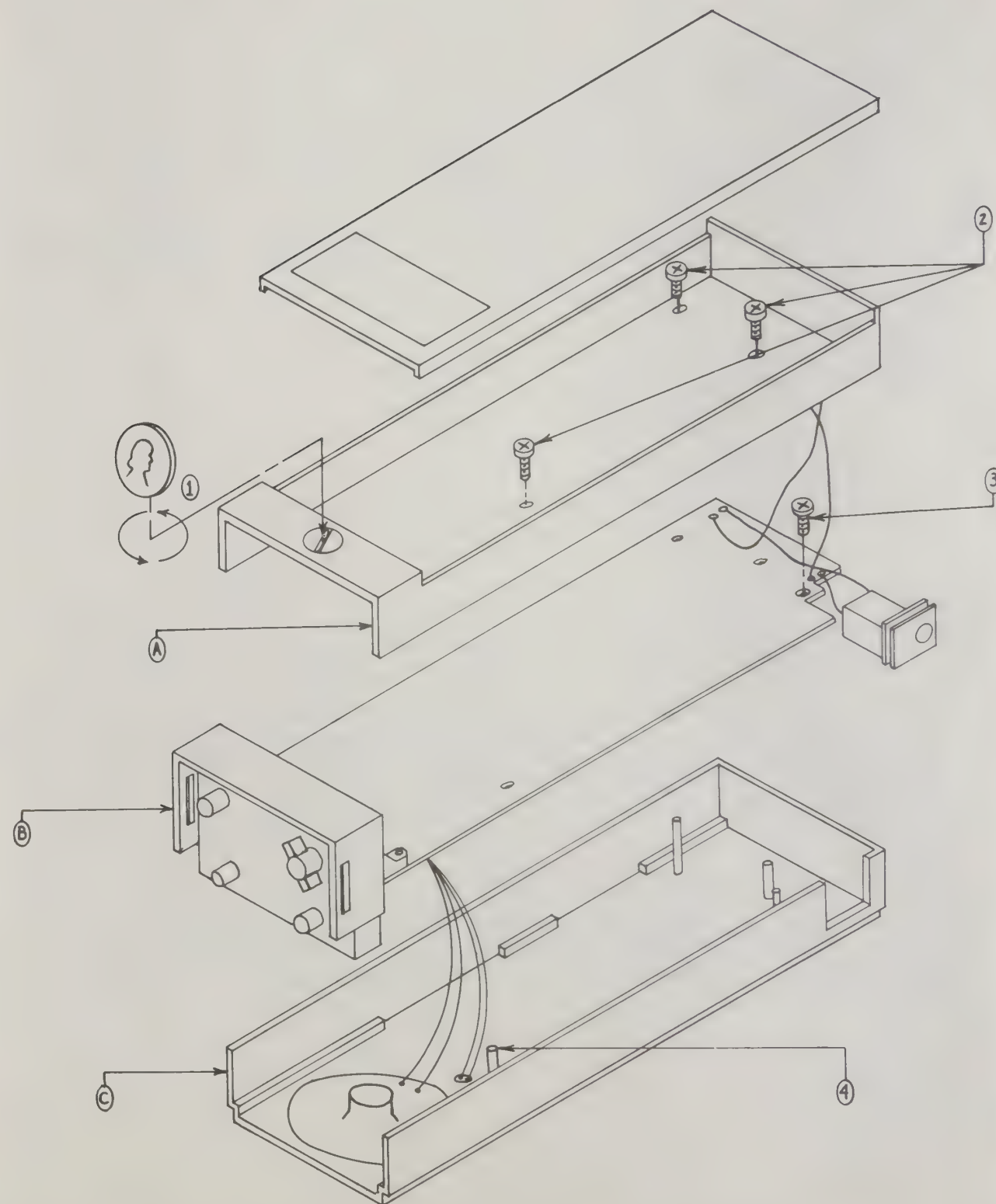
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Reassembly of the 50-050 is generally the reverse of disassembly, but additional care should be taken. When mating the main circuit board and the case front, make sure the speaker and microphone wires are under the circuit board but not positioned so as to interfere with fit of the circuit board to the mounting post (4).

With the case front and circuit board at an angle, mate the two assemblies at the top, slip the charge jack in the retaining slot and press the bottom of the circuit board into the case front. Install and tighten the circuit board mounting screw (3).

Making sure no interconnect wires are extending past the circuit board edges, slip the top of the battery case under the control plate lip. Guiding the battery case interconnect wiring into the space between the charge jack and case bottom, press the battery case into position and insert the 3 retaining screws.

Install batteries and lock the battery cover in place.



<u>F.E.T.</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>GATE1, GATE2</u>	<u>DRAIN</u>	<u>SOURCE</u>
Q1	3SK40/3SK45	0 5.65	10.96	0.57
Q2	JF1033B	0	10.59	1.93
Q4	JF1033B	0	9.97	1.9
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q3	2SC2668	2.67	11.1	1.95
Q5	2SC2688	0.72	1.2	0
Q6	2SC1311	4.75	4.97	4.15
Q7	2SC1311	0.63	0.79	0
Q8	2SC1311	4.25	4.95	3.74
Q9	2SC1311	0	2.03	0
Q10	2SC2688	2.35	10.14	1.68
Q11	2SC1311	2.1	2.88	1.71
Q12 SQ(UNSQ)	2SC1311	0.65(0.66)	1.08(0.95)	0
Q13 SQ(UNSQ)	2SC1311	5.4 (5.78)	6.5 (6.17)	5.0 (5.23)
Q14 SQ(UNSQ)	2SC1311	0.67(0.13)	0.02(9.85)	0
Q15 SQ(UNSQ)	2SC1311	0.02(7.88)	11.9(9.93)	0.36(7.42)
Q16 SQ(UNSQ)	2SA695	11.9(9.92)	0 (5.2)	11.9(10.58)
Q17 SQ(UNSQ)	2SC1209	0 (5.2)	12.0(12.0)	0.37(4.98)
Q18 SQ(UNSQ)	2SA695	0 (4.2)	0 (0)	0.36(4.6)
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q19	2SC1311	2.55(TX)	4.15(TX)	2.0(TX)
Q20	2SC2668	1.58(TX)	4.3 (TX)	0.9(TX)
Q21	2SC710	0.99(TX)	5.15(TX)	0.3(TX)
Q22	2SC710	0 (TX)	10.42(TX)	1.53(TX)
Q23	2SC710	0 (TX)	11.9(TX)	1.88(TX)
Q24	MRF515	0 (TX)	8.78(TX)	0 (TX)
Q25	MRF237	0 (TX)	11.9(TX)	0 (TX)
Q26	2SC1311	0.66(TX)	0.96(TX)	0 (TX)
Q27	2SC1311	4.9 (TX)	7.5 (TX)	4.46(TX)
Q28	MPSA13	1.66(TX)	2.6 (TX)	0.52(TX)
Q29	2SC1209	11.9(RX)	12.0(RX)	11.3(RX)
		0.97(TX)	12.0(TX)	0.21(TX)
Q30	2SA695	12.0(RX)	0.2 (RX)	12.0(RX)
		11.2(TX)	11.9(TX)	12.0(TX)
<u>TRANSISTOR</u> <u>REF.NO.</u>	<u>DESCRIPTION</u>	<u>BASE</u>	<u>COLLECTOR</u>	<u>EMITTER</u>
Q31	2SA733	10.6 (RX)	11.3(RX)	12.0(RX)
		11.1 (TX)	8.45(TX)	12.0(TX)



1. Remove Tx crystals to prevent possible equipment damage during receiver alignment.
2. Install the receiver crystals and connect a VHF frequency counter to TP1 (R8). Turn the unit on and, selecting each channel in turn, adjust the appropriate trimmer capacitor for the proper frequency (channel frequency -10.7 MHz). Set the channel switch to the mid-range channel and connect an on-channel signal generator to the antenna connector. Modulate the generator with 1000 Hz at 3 KHz deviation and adjust the RF level to give a 12 db SINAD receiver speaker output.
3. Adjust T8 and T9 for maximum SINAD, readjusting the generator level for 12 db SINAD as necessary. Repeat this procedure for T1 and T2, then T3 and T4. Increase the signal generator by 20 db and tune T5, T6, and T7 for minimum receiver output distortion.

## TRANSMITTER ALIGNMENT

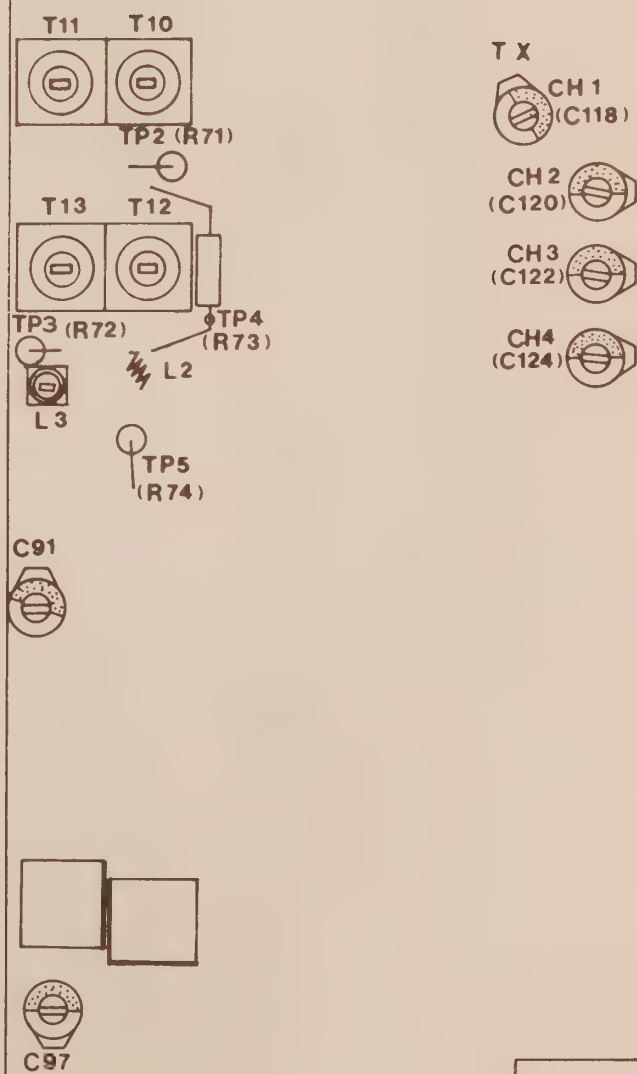
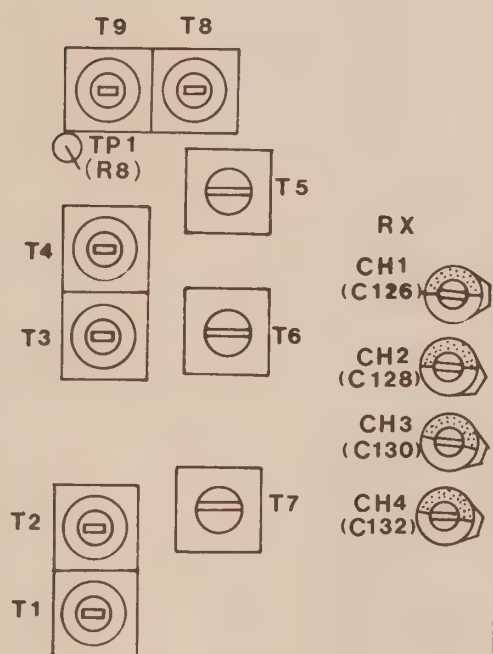
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1. Install the transmitter crystals and connect a wattmeter and 50 ohm load to the antenna connector. Turn the radio on and set the channel switch to a mid-range channel. Set the RF power output switch to the "HI" position.
2. Connect a DC voltmeter to TP2 (R71). Adjust T10 and T11 for a maximum voltage reading. Reconnect the voltmeter to TP3 (R72) and adjust T12 and T13 for a maximum reading.
3. Reconnect the voltmeter to TP4 (R73) and connect the voltmeter ground lead to TP5 (R74). Alternately adjust L2 and L3 for a maximum voltmeter reading, noting that L2 must be uniformly spread for higher frequencies and compressed for lower frequencies. When L2 and L3 are peaked adjust L3 clockwise past the peak to the point where a decrease is observed on the voltmeter.
4. Adjust C91 and C97 for maximum RF output power, then readjust C97 for 2 watts output.
5. Loosely couple a VHF frequency counter to the output and adjust the appropriate oscillator trimmer capacitor for the correct frequency on each channel.
6. Monitor the transmitter output with a modulation meter. Connect an audio generator to TP6 (R79) and adjust the generator frequency and level to produce maximum transmitter deviation. Adjust VR3 for desired maximum deviation (monitoring both positive and negative peaks) up to a maximum of 5 KHz.

# RECEIVER ALIGNMENT POINTS

# TRANSMITTER ALIGNMENT POINTS

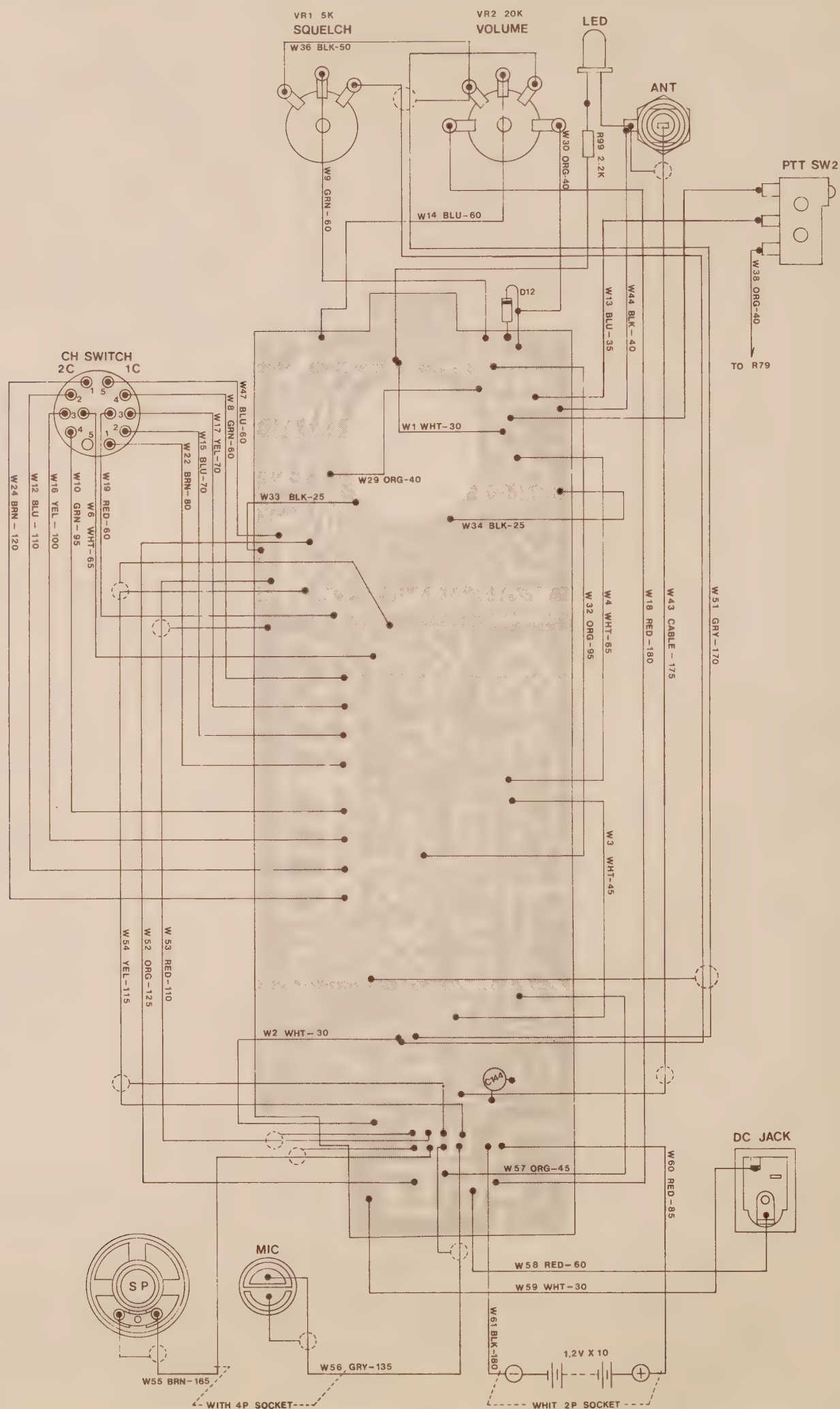
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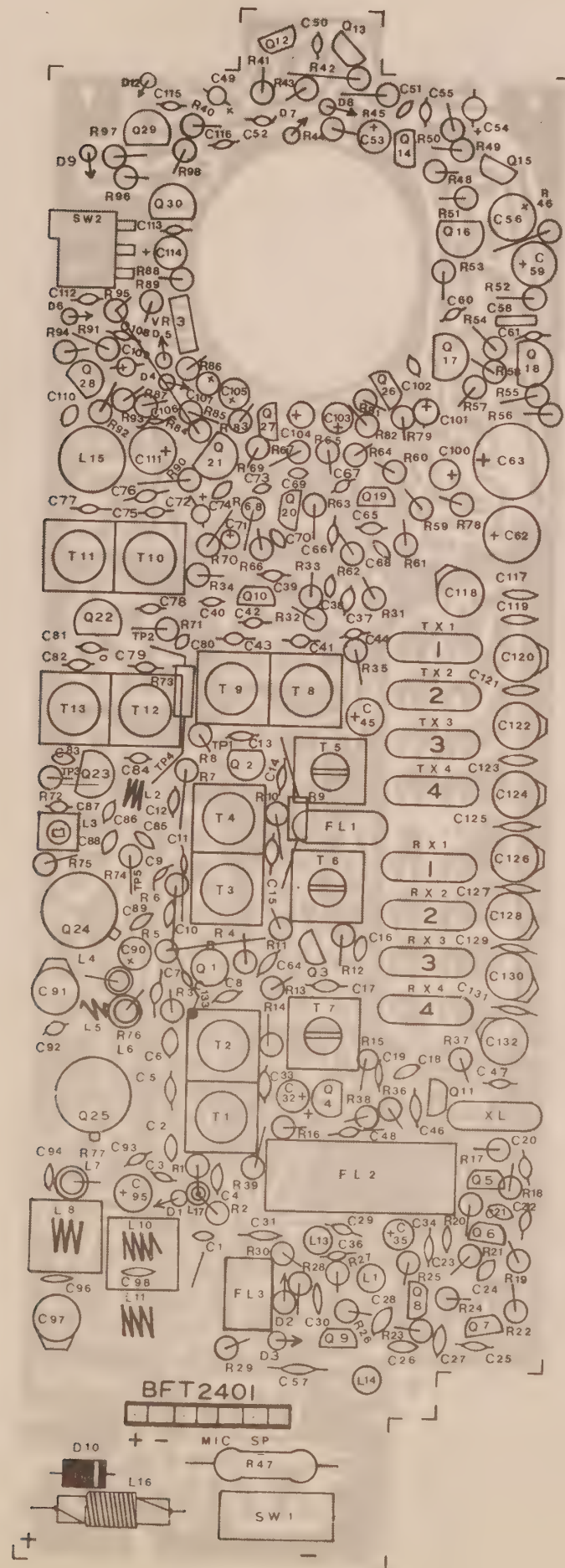




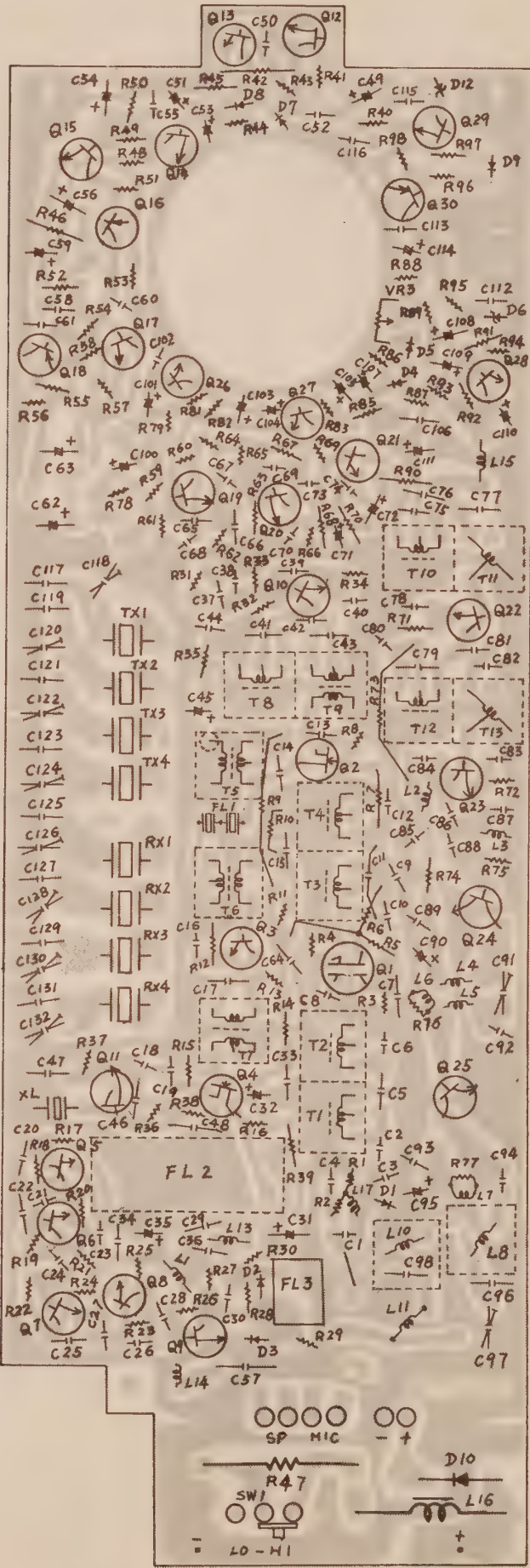
## EXTERNAL WIRING DIAGRAM

50-050



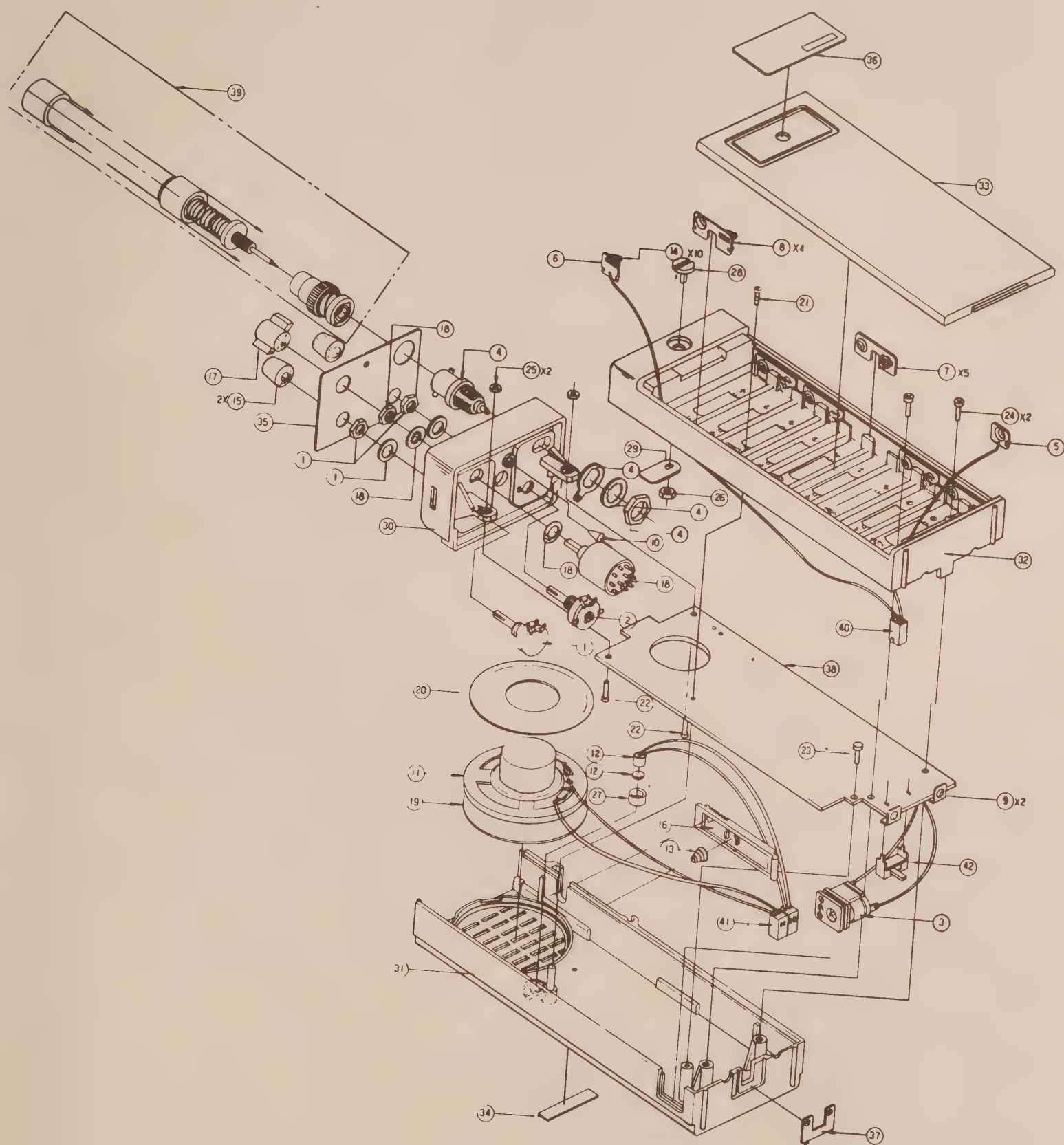






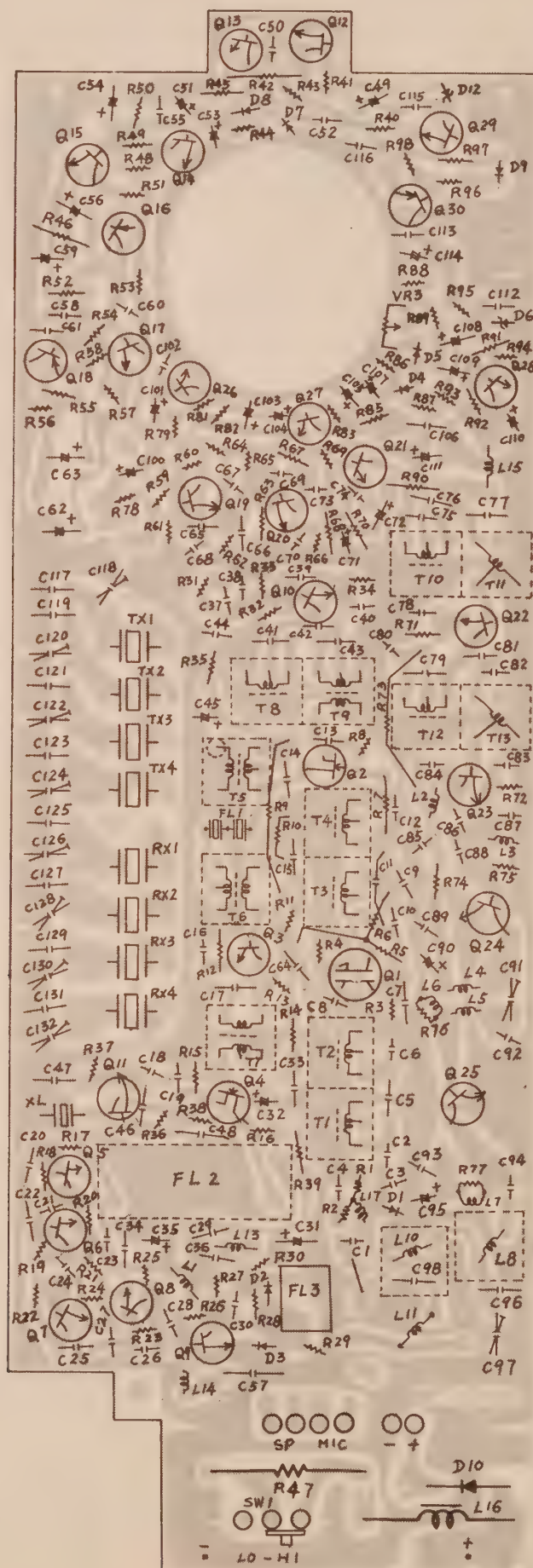
## EXPLODED MECHANICAL VIEW

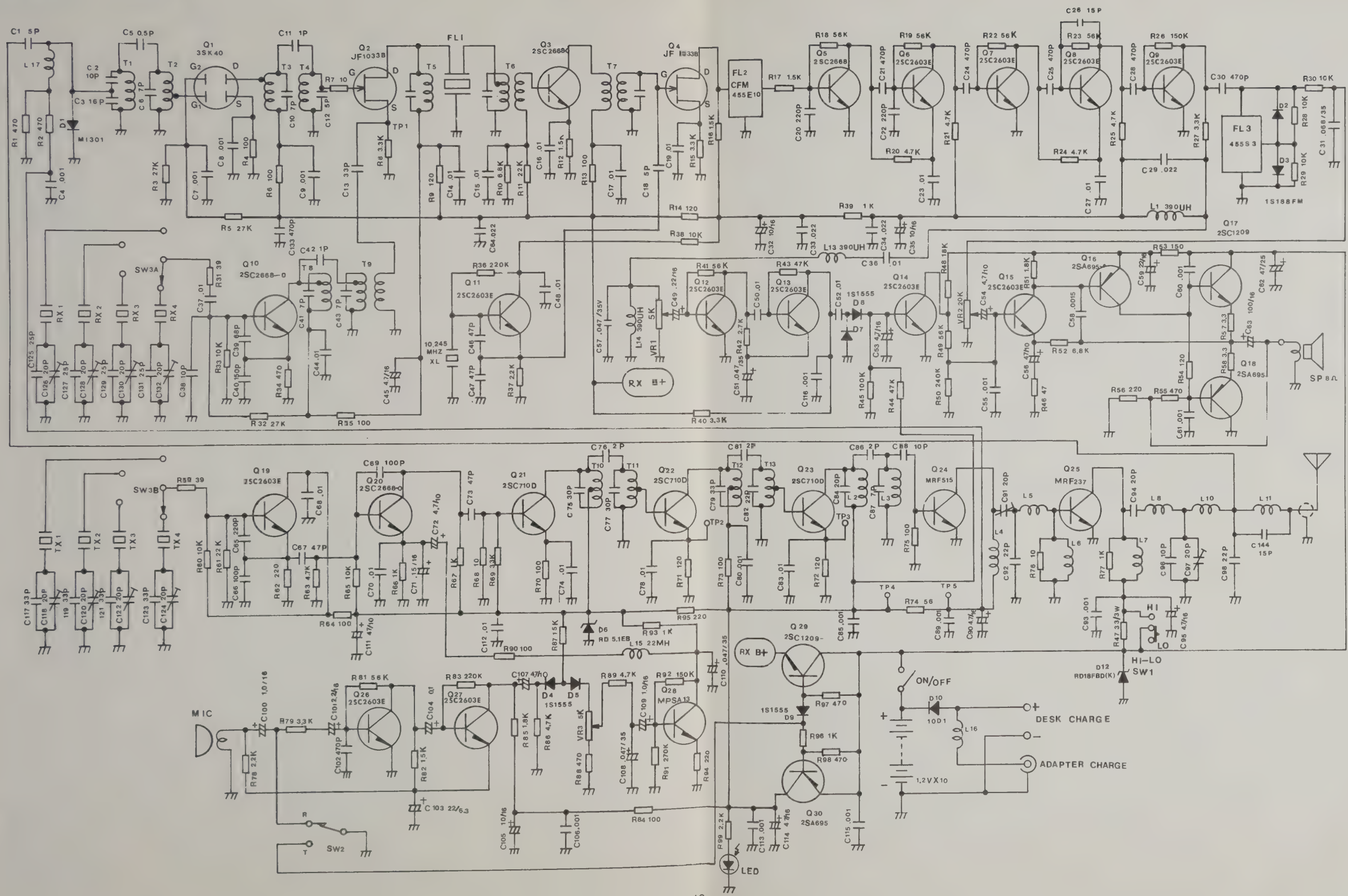
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**FOLD OUT**









# PARTS LIST

50-050

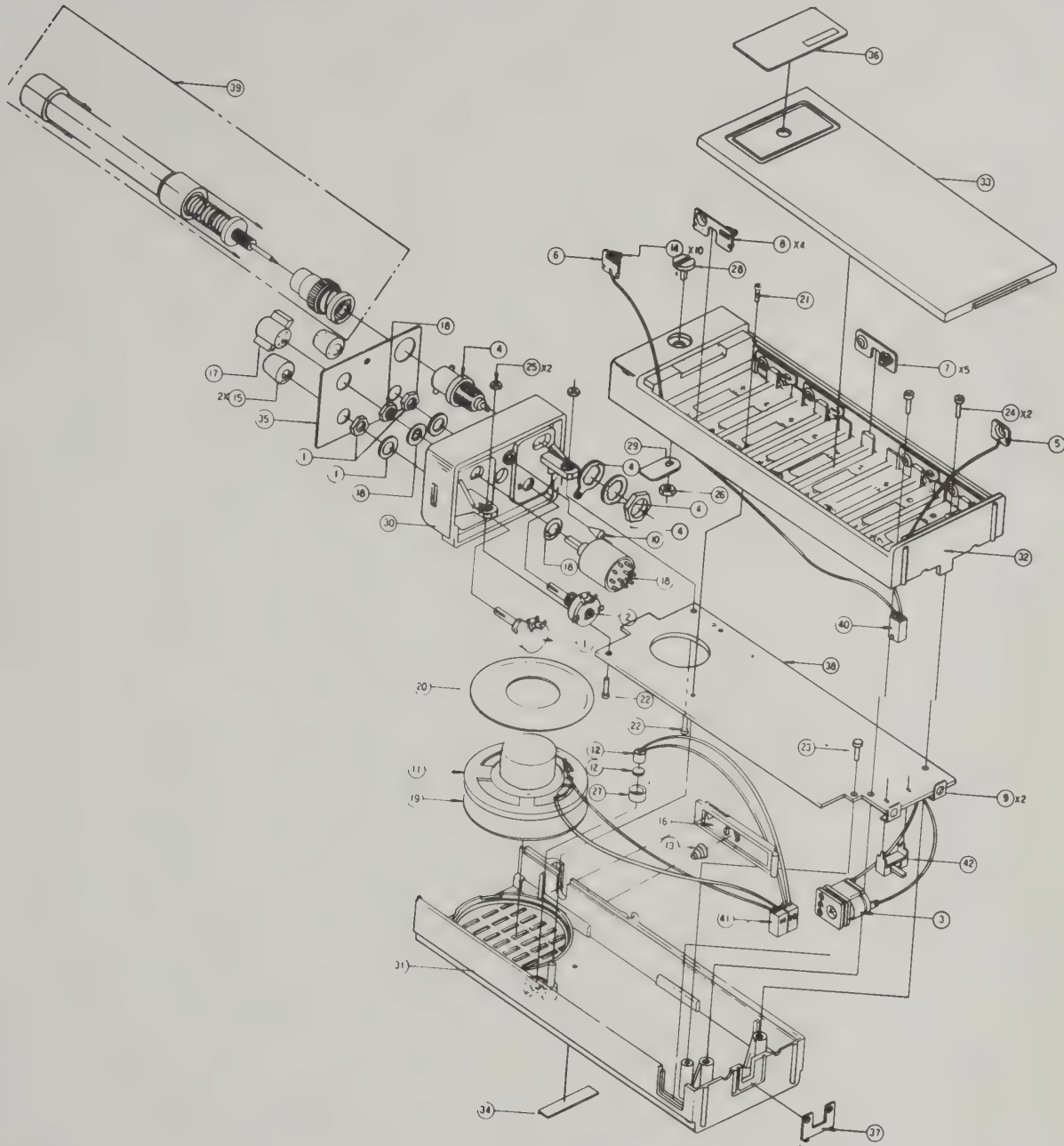
<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>CASE MATERIAL (EXPLODED VIEW)</u>		
1 (VR1)	Squelch Control 5K-B	50-166004
2 (VR2)	Volume Control 20K-D	70-160005
3	Jack, DC-12V	70-153026
4	Jack, Antenna	70-153027
5	Contact Batt (+)	70-152008
6	Contact Batt (-)	70-152009
7	Contact Batt (+1-)	70-152010
8	Contact Batt (-1+)	70-152011
9	Contact, Charge	70-152012
10 (LED)	L.E.D. SR105D	70-202006
11	Speaker	70-060008
12	MC	70-038010
13	Spring P.T. Switch	70-152013
14	Spring Batt Contact	70-152014
15	Knob, Volume	70-110007
16	Knob, P.TT.	50-118002
17	Knob, Channel	70-115008
18	Switch, Channel	70-180009
19	Cover, Speaker Cloth	70-157036
20	Frame, Speaker Insulator	70-158041
21	Screw	70-151155
22	Screw	70-151156
23	Screw	70-151157
24	Screw	70-151158
25	Nut	70-151151
26	Nut	70-151148
27	Rubber Ring Mic	70-157037
28	Button Batt Cover	70-151159
29	Spr'g Plate Batt Cover	70-152015
30	Top, Case (Sw Mgt)	70-010024
31	Front, Case	50-010005
32	Rear, Case	50-010006
33	Cover, Batt	50-010007
34	Plate, Name Front	70-020036
35	Plate, SW	50-020012
36	Plate, Case Rear	50-020011
37	Plate, H/L	50-020010
38	PC Board	50-070010
39	Antenna, Flex.	50-040001
40	Socket 2P	50-159008
41	Socket 4P	50-159009
42 (SWI)	Switch Slide	50-183001

## MISCELLANEOUS

	Strap Shoulder	70-036001
	Carrying Case	50-036001
	Gasket, Knob	50-157012
	Button, Shoulder Strap	70-036002
+/-	Pin Waffer, 2P	50-159006
MIC/SP	Pin Waffer, 4P	50-159007

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>MISCELLANEOUS (CONT.)</u>		
F/Q25	Socket, Xtal	70-159039
	Screw F/SWZ	70-151153
	Nut, 1.6 X 1.5	50-151023
	Case, Shield	70-089035
	Heat Sink	70-089036
	Insulator, Crystal	50-089009
<u>CRYSTALS</u>		
XL	10.245	70-128012
TX1	13.025	50-128019
TX2	13.066666	50-128020
RX1	16.177777	50-128021
RX2	16.233333	50-128022
<u>SWITCH</u>		
SW-2	Switch, Micro P/T	70-183014
<u>CONTROLS</u>		
VR3 (1)	Trim Potentiometer 5K ohm	70-164014
VR1 (2)	Squelch Control, 5K-B	50-166004
VR2	Volume Control, 20K-D	70-160005
<u>COILS &amp; TRANSFORMERS</u>		
L1, 13, 14	Coil, Choke	70-178014
L15	Coil, Choke	70-178015
L7	Coil, Choke	70-178019
T5, 6, 7	IFT	70-090066
T1, 2, 3, 4	Coil, Rx RF	70-090067
T8	Coil Rx Oscillator	70-090068
T12	Coil, Tripler	70-090068
T9	Coil Rx Oscillator	70-090069
T11	Coil, Tx Doubler	70-090070
T10	Coil, Tx Doubler	70-090071
T13	Coil, Tripler	70-090072
L6	Coil, Choke	70-178016
L4, 18	Coil, Choke	70-178017
L3	Coil	70-178028
L16, 17	Coil, Choke	70-178018
L5	Coil, RF Coupling	70-178020
L2	Coil, Doubler	70-178021
L10	Coil RF Coupling	70-178022
L8	Coil, RF Coupling	70-178023
L11	Coil, RF Coupling	70-178024





REF. NO.	DESCRIPTION	PART NO.
CASE MATERIAL (EXPLODED VIEW)		
1 (VR1)	Squelch Control 5K-B	50-166004
2 (VR2)	Volume Control 20K-D	70-160005
3	Jack, DC-12V	70-153026
4	Jack, Antenna	70-153027
5	Contact Batt (+)	70-152008
6	Contact Batt (-)	70-152009
7	Contact Batt (+1-)	70-152010
8	Contact Batt (-1+)	70-152011
9	Contact, Charge	70-152012
10 (LED)	L.E.D. SR105D	70-202006
11	Speaker	70-060008
12	MC	70-038010
13	Spring P.T. Switch	70-152013
14	Spring Batt Contact	70-152014
15	Knob, Volume	70-110007
16	Knob, P.TT.	50-118002
17	Knob, Channel	70-115008
18	Switch, Channel	70-180009
19	Cover, Speaker Cloth	70-157036
20	Frame, Speaker Insulator	70-158041
21	Screw	70-151155
22	Screw	70-151156
23	Screw	70-151157
24	Screw	70-151158
25	Nut	70-151151
26	Nut	70-151148
27	Rubber Ring Mic	70-157037
28	Button Batt Cover	70-151159
29	Spr'g Plate Batt Cover	70-152015
30	Top, Case (Sw Mgt)	70-010024
31	Front, Case	50-010005
32	Rear, Case	50-010006
33	Cover, Batt	50-010007
34	Plate, Name Front	70-020036
35	Plate, SW	50-020012
36	Plate, Case Rear	50-020011
37	Plate, H/L	50-020010
38	PC Board	50-070010
39	Antenna, Flex.	50-040001
40	Socket 2P	50-159008
41	Socket 4P	50-159009
42 (SWI)	Switch Slide	50-183001

MISCELLANEOUS

Strap Shoulder	70-036001
Carrying Case	50-036001
Gasket, Knob	50-157012
Button, Shoulder Strap	70-036002
Pin Waffer, 2P	50-159006
Pin Waffer, 4P	50-159007

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>MISCELLANEOUS (CONT.)</u>		
F/Q25	Socket, Xtal	70-159039
	Screw F/SWZ	70-151153
	Nut, 1.6 X 1.5	50-151023
	Case, Shield	70-089035
	Heat Sink	70-089036
	Insulator, Crystal	50-089009
<u>CRYSTALS</u>		
XL	10.245	70-128012
TX1	13.025	50-128019
TX2	13.066666	50-128020
RX1	16.177777	50-128021
RX2	16.233333	50-128022
<u>SWITCH</u>		
SW-2	Switch, Micro P/T	70-183014
<u>CONTROLS</u>		
VR3 (1)	Trim Potentiometer 5K ohm	70-164014
VR1 (2)	Squelch Control, 5K-B	50-166004
VR2	Volume Control, 20K-D	70-160005
<u>COILS &amp; TRANSFORMERS</u>		
L1, 13, 14	Coil, Choke	70-178014
L15	Coil, Choke	70-178015
L7	Coil, Choke	70-178019
T5, 6, 7	IFT	70-090066
T1, 2, 3, 4	Coil, Rx RF	70-090067
T8	Coil Rx Oscillator	70-090068
T12	Coil, Tripler	70-090068
T9	Coil Rx Oscillator	70-090069
T11	Coil, Tx Doubler	70-090070
T10	Coil, Tx Doubler	70-090071
T13	Coil, Tripler	70-090072
L6	Coil, Choke	70-178016
L4, 18	Coil, Choke	70-178017
L3	Coil	70-178028
L16, 17	Coil, Choke	70-178018
L5	Coil, RF Coupling	70-178020
L2	Coil, Doubler	70-178021
L10	Coil RF Coupling	70-178022
L8	Coil, RF Coupling	70-178023
L11	Coil, RF Coupling	70-178024



# PARTS LIST

50-050

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>TRANSISTORS</u>		
Q16, 18, 30	2SA695D	70-080042
Q21, 22, 23	2SC710D	70-080043
Q6, 7, 8, 9, 14, 15, 19, 26, 27	2SC2603E	70-080057
Q11, 12, 13	2SC1209D	70-080046
Q17, 29	2SC26680	01-032668
Q3, 5, 10, 20	3SK40	70-080047
Q1	3SK45B	70-080048
SUB #1	3N201	70-080049
SUB #2	2SC741	70-080051
Q24	MRF 515	70-080050
SUB	MRF 237	70-080022
Q25	JF 1033B	70-080052
Q2, 4	MPSA 13	70-080053
Q28		
<u>DIODES</u>		
D4, 5, 7, 8, 9	IS1555	70-085020
D2, 3	IS188FM	70-085023
D10	10D1	70-085022
D6	RD5.1 EB - 2/3	70-085024
D12	RD18FB-D	70-085025
D1	MI301	70-085026
<u>FILTERS</u>		
FL2	Filter Ceramic CFM455E10	70-179010
FL3	Filter Ceramic CFY455S3	70-179011
FL1	Filter Xtal 10M15A	70-179012
<u>CARBON RESISTORS</u>		
R57, 58	3.3 ohm 1/4 W	70-141086
R7	10 ohm 1/4 W	70-141057
R31, 59	39 ohm 1/4 W	70-141058
R46	47 ohm 1/4 W	70-141059
R74	56 ohm 1/4 W	70-141060
R4, 6, 13, 35, 64, 70, 73, 75, 84, 90	100 ohm 1/4 W	70-141061
R9, 14, 54, 71	120 ohm 1/4 W	70-141062
R53	150 ohm 1/4 W	70-141063
R56, 62, 94, 95	220 ohm 1/4 W	70-141064
R1, 2, 34, 55, 88, 97, 98	470 ohm 1/4 W	04-004710
R39, 66, 67, 93, 96	1K 1/4 W	04-000013
R12, 16, 17, 82	1.5K 1/4 W	70-141065
R51, 85	1.8K 1/4 W	70-141066
R37, 78, 99	2.2K 1/4 W	70-141067
R42	2.7K 1/4 W	70-141068
R8, 15, 27, 40, 79	3.3K 1/4 W	70-141069

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>CARBON RESISTORS (CONT.)</u>		
R20, 21, 24, 25, 63, 86, 89	4.7K 1/4 W	70-141070
R10, 52	6.8K 1/4 W	70-141071
R28, 29, 30, 33, 38, 60, 65, 68	10K 1/4 W	70-141072
R87	15K 1/4 W	70-141073
R48	18K 1/4 W	70-141074
R11, 61	22K 1/4 W	70-141075
R3, 5, 32	27K 1/4 W	70-141076
R69	33K 1/4 W	70-141077
R43, 44	47K 1/4 W	70-141078
R18, 19, 22, 23, 41, 49, 81	57K 1/4 W	70-141079
R45	100K 1/4 W	70-141080
R26, 92	150K 1/4 W	70-141081
R36, 83	220K 1/4 W	70-141082
R50	240K 1/4 W	70-141083
R91	270K 1/4 W	70-141084
<u>METAL FILM RESISTOR</u>		
R47	330 ohm 3 W	01-033300
<u>TRIMMER CAPACITORS</u>		
C91, 97, 118, 120, 122, 124, 126, 128, 130, 132	20-5-1-C	70-123014
<u>CERAMIC CAPACITORS</u>		
C4, 7, 8, 9, 55, 60, 61, 80, 85, 89, 93, 106, 113, 115, 116, 151, 152	.001uF, 50V	70-132003
C21, 24, 25, 28, 30, 102, 133	470PF, 50V	50-131075
C6, 10, 41, 43, 87	7PF, 50V	50-131076
C5	.5PF, 50V	50-131077
C11, 42	1PF, 50V	50-131078
C76, 81, 86	2PF, 50V	50-131079
C1, 12, 18,	5PF, 50V	50-131080
C84, 94	20PF, 50V	70-131119
C26, 144	15PF, 50V	50-131081
C39	68PF, 50V	70-131109
C2, 38, 88, 96	10PF, 50V	70-131110
C3	16PF, 50V	70-131111
C82, 92, 98	22PF, 50V	50-131082
C75, 77	30PF, 50V	70-131112
C13, 79, 117, 119 121, 123	33PF, 50V	50-131083



<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
<u>CERAMIC CAPACITORS (CONT.)</u>		
C125, 127, 129, 131	25PF, 50V	70-131114
C66, 69	100PF, 50V	50-131084
C46, 47	47PF, 50V	70-131113
<u>MULTI CERAMIC CAPACITORS</u>		
C69, 73	47PF	70-131116
C40	150PF	70-131117
C20, 22, 65	220PF	70-131118
C29, 33	X7R .022V	70-132022
C36, 112	X7R .01V	70-132023
<u>MYLAR CAPACITORS</u>		
C58	.0015uF	70-137022
<u>TANTALUM CAPACITORS</u>		
C51, 57, 108, 110	.047uF, 35V	70-138044
C31	.068uF, 35V	70-138045
C104	.1uF, 16V	70-138046
C71	.15uF, 16V	70-138047
C49	.22uF, 16V	70-138048
C107	4.7uF, 10V	70-138055
<u>ELECTROLYTIC CAPACITORS</u>		
C100, 109	1uF, 16V	50-135001
C101	2.2uF, 16V	70-135038
C45, 53, 54, 72, 90, 95, 114	4.7uF, 16V	70-135039
C32, 35, 105	.10uF, 16V	50-135002
C103	22uF, 6.3V	50-135003
C59	22uF, 16V	50-135004
C56, 111	47uF, 16V	50-135005
C62	47uF, 25V	70-135040
C63	100uF, 16V	50-135006
<u>SEMI CONDUCTOR CAPACITORS</u>		
C14, 16, 17, 19, 23, 27, 37, 44, 48, 50, 52, 68, 70, 74, 78, 83	.01uF TCX	70-139003
C34, 64	.022uF TCX	70-139002

<u>PART NO.:</u>	<u>DESCRIPTION:</u>	<u>MODEL NO.:</u>
70-035001	Vinyl Case	
70-036001	Shoulder Strap	
70-050001	Standard Flexible Antenna	
70-098007	Battery Charger, Wall Type	70-C09
	2 Pr. Crystals (Factory Installed, CH 6 and 16)	
70-030004	Rechargeable "AA" size battery (10 per radio)	70-B02

OPTIONAL ACCESSORIES:

70-035004	Leather Case	70-L01
70-098008	Battery Charger, Desk Type	70-C08

## PARTS ORDERING INFORMATION

HOW TO ORDER REPLACEMENT PARTS

NOTE: To eliminate error and speed delivery of replacement parts, always include the following information on your order:

1. Complete identification of model which requires the part.
  - A. Model Number
  - B. Serial Number
2. Best possible identification of the part itself.
  - A. Part Number
  - B. Schematic Reference Number
  - C. Part Description
  - D. Quantity Requested
  - E. If necessary, return old part as sample



